(12) UK Patent Application (19) GB (11) 2 049 823 A

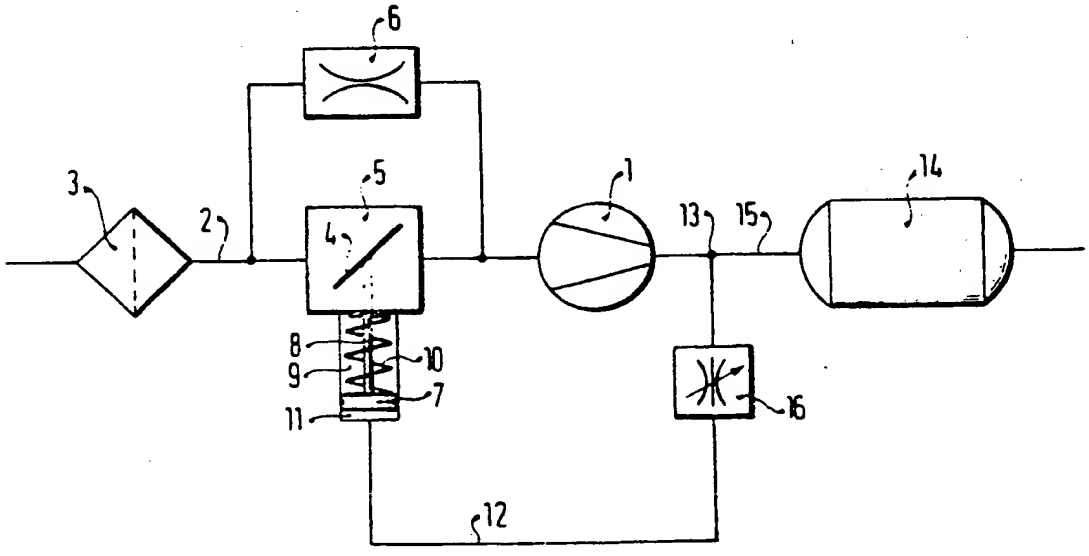
(21) Application No 8014355
(22) Date of filing 1 May 1980
(30) Priority data
(31) 2920685
(32) 22 May 1979
(33) Fed. Rep of Germany (DE)
(43) Application published 31 Dec 1980
(51) INT CL³ F04B 49/02
(52) Domestic classification F1N 2D2F
(56) Documents cited
US 4171188A
GB 1089694
GB 1047022
GB 871328
GB 743094
(58) Field of search F1N
(71) Applicant
Robert Bosch GMBH., of Postfach 50, 7000 Stuttgart 1, Federal Republic of Germany

(72) Inventors
Gerald Höfer,
Eckart Damson
(74) Agent
W. P. Thompson & Co

(54) Improvements in or Relating to Systems for Producing Compressed Air

(57) A compressed air system having a reservoir 14 charged by a compressor 1 has an intake throttle 5 controlled in response to the pressure prevailing in the reservoir 14. Intake throttle 5 is either progressively controlled by a piston 7 loaded by a spring 10 and subjected to reservoir pressure through a line 12, 15 or moved between fully open and closed positions by pulses emitted by a two-state regulator (17) responsive to reservoir pressure. A fixed throttle in parallel with the intake throttle allows some air to enter the compressor when the throttle valve is closed thereby to inhibit oil escaping from the compressor. The system is preferably used in compressed air brake systems of motor vehicles.

FIG. 1



GB 2 049 823 A

1/2.

FIG. 1

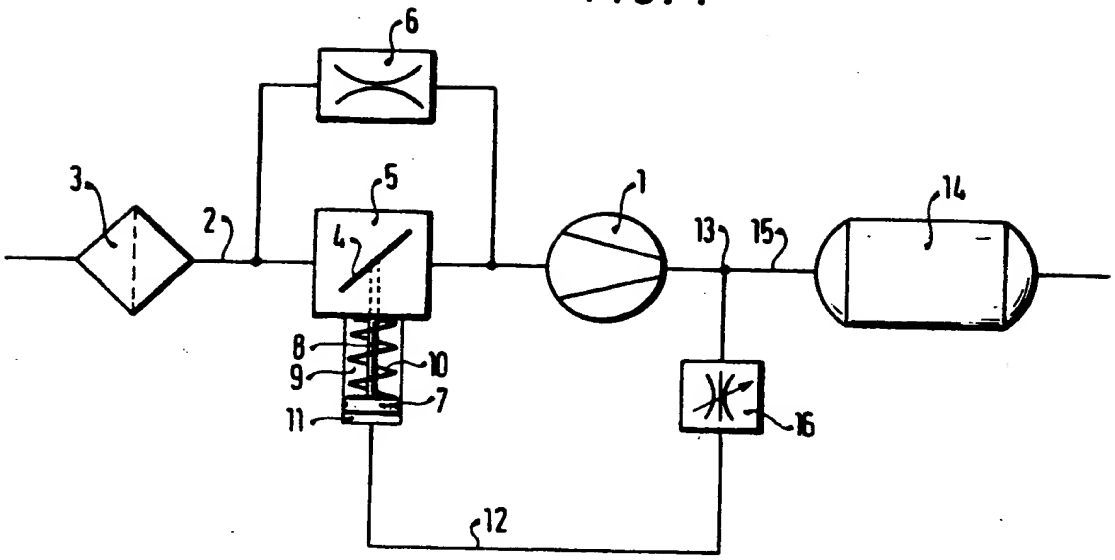
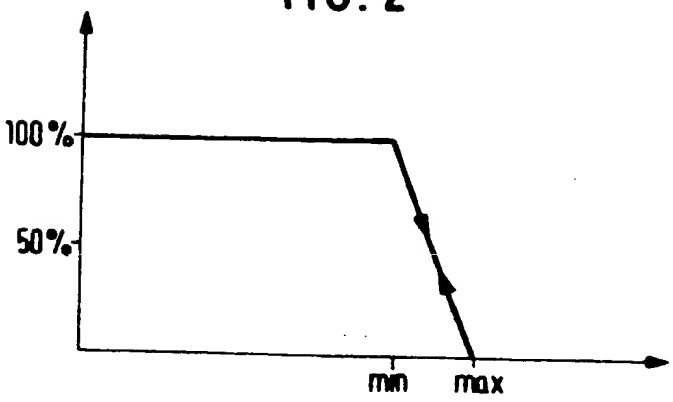


FIG. 2



2/2.

FIG. 3

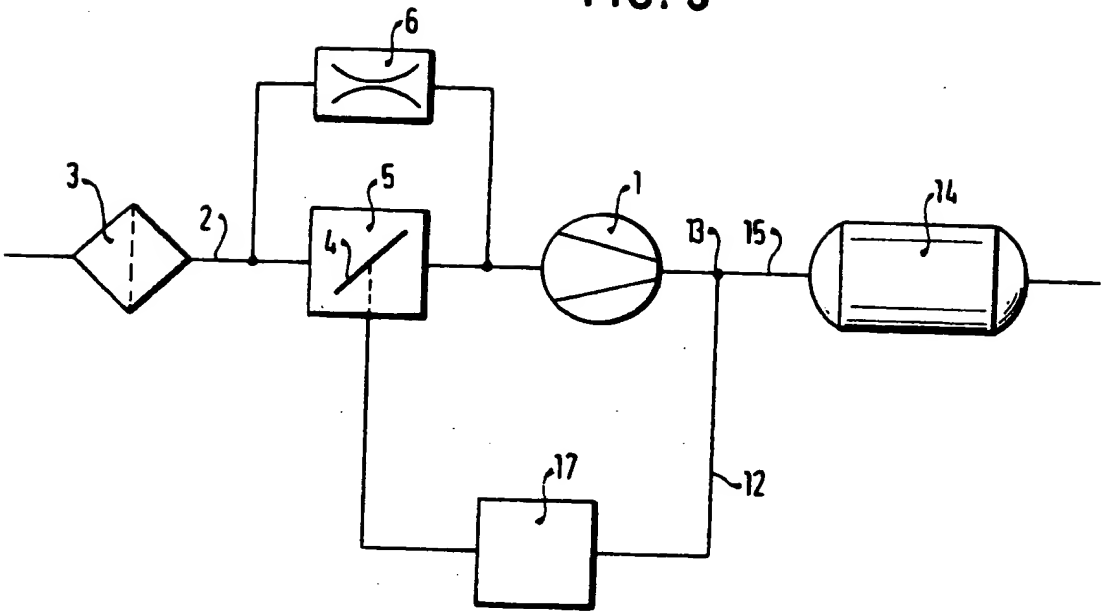
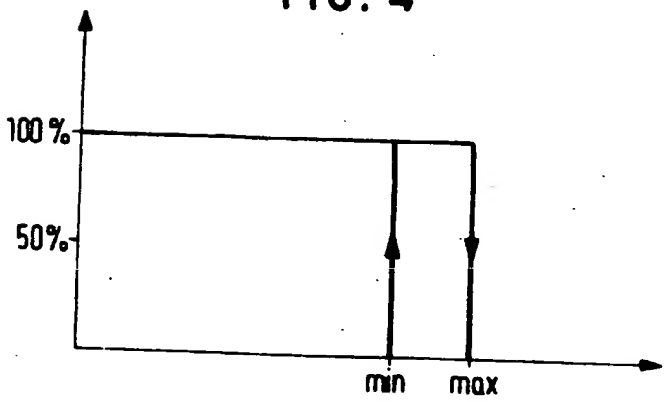


FIG. 4



SPECIFICATION

Improvements in or Relating to Systems for Producing Compressed Air

The present invention relates to systems for producing compressed air.

In one known system for producing compressed air as disclosed in German Offenlegungsschrift No. 2,717,224, a compressor is switched off when the consumption of air drops below a specific limit. This has the disadvantage that a lubricating film required in the compressor is broken each time the compressor is switched off, thus leading to increased wear on the moving parts of the compressor.

According to the present invention there is provided a system for producing compressed air comprising a compressor, a reservoir, and a regulator which is provided with an adjustable intake throttle, in which the quantity of air delivered to the reservoir by the compressor is regulated in direct dependence on the quantity of compressed air called for from the reservoir by a load at any given time, and the pressure in the reservoir is raised up to a predetermined upper limiting valve when the quantity of air extracted by the load drops below a minimum quantity, the intake throttle being designed such that the volumetric flow drawn in by the compressor is throttlable from a substantially unobstructed flow-through down to zero flow-through, and the feed pressure of the volumetric flow established after adjustment of the intake throttle is lower than the maximum reservoir pressure.

In a system embodying the present invention preferably a minimum volumetric flow is maintained. The pressure of this volumetric flow serves to return to the crankcase of the compressor oil which has entered the compression space from the compressor. The consumption of oil by the compressor can thereby be substantially reduced and a solution provided to the known lubricating problem which resides in the fact that, on the one hand, the compressor has to be lubricated and, on the other hand, the smallest possible quantity of this lubricant should be removed from the compressor by the compressed air which is delivered.

The invention will be further described by way of example with reference to the accompanying drawings, in which:—

Fig. 1 is a block diagram of a system for producing compressed air according to a first embodiment of the invention including a proportional controller regulator;

Fig. 2 shows a pressure characteristic of proportional regulation of the system of Fig. 1;

Fig. 3 is a block diagram of a second embodiment of the invention having a two-state regulator, and

Fig. 4 shows a pressure characteristic of two-state regulation of the system of Fig. 3.

Referring first to Fig. 1 of the drawings a compressor 1 draws in air by way of a suction line 2. The suction line 2 incorporates an air filter 3 and an intake throttle 5 provided with a butterfly valve 4. Air is also drawn in through a preferably fixed by-pass throttle 6 provided in parallel with the intake throttle 5.

The intake throttle 5 has an adjusting piston 7 which is connected to the butterfly valve 4 by way of a piston rod 8.

One face of the adjusting piston 7 in part defines a spring chamber 9 through which the piston rod 8 passes and which accommodates a spring 10. The other face of the adjusting piston 7 forms a movable wall of a working chamber 11 to which a control line 12 is connected.

The control line 12 commences from a line location 13 which is located in a pressure line 15 between the compressor 1 and a reservoir 14. A damper 16 is fitted in the control line 12.

The system of Fig. 1 operates as follows:

The control line 12 is pressure-free when the reservoir 14 is empty. The spring 10 has pressed the adjusting piston 7 into a position such that the butterfly valve 4 has opened the passage through the suction line 2. The full intake cross-section of the intake throttle 5 is thus opened. The volumetric flow is 100%. The reservoir 14 is filled.

When a predetermined pressure has been attained in the reservoir, the adjusting piston 7, retarded by the damper 16, commences its stroke against the force of the spring 10. The butterfly valve 4 is adjusted, and the intake throttle 5 regulates the volumetric flow in the suction line 2 continuously down to approximately 0% by virtue of the fact that movement of the butterfly valve 4 continuously reduces the cross-section of the passage available through the intake throttle 5.

However, even when the intake throttle 5 is fully closed, a certain minimum volumetric flow through the by-pass throttle 6 is maintained. Thus, lubricating oil entering the compression space from the compressor 1 continuously flows back to the compressor 1 in dependence upon feed pressure. In this manner, it is a very simple matter to minimise the oil consumption of the compressor 1.

The maximum reservoir pressure is then finally attained. If the reservoir pressure drops as a result of, for example, compressed air being taken by a load connected downstream of the reservoir, the spring 10 adjusts the butterfly valve 4 in conformity with the reservoir pressure to a value between 0% and approximately 100% volumetric flow.

A graph of the pressure characteristic is shown in Fig. 2, the volumetric flow being plotted along the ordinate and the reservoir pressure being plotted along the abscissa.

Fig. 3 shows a compressed air producing system which is modified relative to the construction shown in Fig. 1. The same reference numerals are used for the parts corresponding to those of the embodiment of Fig. 1.

The adjusting piston 7, the spring 10 and the damper 16 have been omitted in the present instance They have been replaced by a two-state regulator 17 fitted in the control line 12.

This system operates as follows:

The control line 12 leading to the two-stage regulator 17 is pressure-free when the reservoir 14 is empty. The two-state regulator 17 opens the intake throttle 5. The volumetric flow is 100%.

When the reservoir pressure approaches maximum pressure, the two-stage regulator 17 closes, or approximately closes, the intake throttle 5 by a control pulse. In any event, a minimum volumetric flow is still maintained through the by-pass throttle 6 in order to maintain the feedback of oil.

If the pressure in the reservoir 14 drops to a minimum pressure as a result of, for example, compressed air being taken by a load connected downstream of the reservoir, the two-stage regulator 17 switches the intake throttle 5 to 100% volumetric flow again.

Fig. 4 is a graph of the pressure characteristic when using a two-stage regulator.

If the compressor 1 is in the form of a piston conpressor, the regulator can be fitted directly in the cylinder head of the piston compressor in a simple manner. Thus, there can be a saving on lines and connections.

It is also conceivable to provide a compressed air producing system with a pressure regulator in a conventional manner, to use the pressure regulator to regulate the pressure in the system, and to combine the construction with a regulator embodying the present invention as an additional regulator.

System for producing compressed air embodying the present invention are particularly suitable for use in compressed air brake systems of motor vehicles.

Claims

1. A system for producing compressed air, comprising a compressor, a reservoir, and a regulator which is provided with an adjustable intake throttle, in which the quantity of air delivered to the reservoir by the compressor is regulated in direct dependence on the quantity of compressed air called for from the reservoir by a load at any given time, and the pressure in the reservoir is raised up to a predetermined upper limiting value when the quantity of air extracted by the load drops below a minimum quantity, the intake throttle being designed such that the volumetric flow drawn in by the compressor is throttlable from a substantially unobstructed flow-through down to zero flow-through, and the feed pressure of the volumetric flow established after adjustment of the intake throttle is lower than the maximum reservoir pressure.

2. A system for producing compressed air as claimed in Claim 1, in which the regulator ensures a permanently flowing minimum volumetric flow.

3. A system for producing compressed air as claimed in Claim 1 or 2, in which a preferably fixed by-pass throttle is provided in parallel with the adjustable intake throttle.

4. A system for producing compressed air as claimed in any of Claims 1 to 3, in which the intake throttle is adjustable in response to the pressure at the inlets to the reservoir by way of a control line containing a damper.

5. A system for producing compressed air as claimed in any of Claims 1 to 4, in which the compressor is a piston compressor and the regulator is fitted in the cylinder head of the piston compressor.

6. A system for producing compressed air as claimed in any of Claims 1 to 5, in which the regulator is used as an additional regulator for a compressed air producing system operating with a conventional pressure regulator.

7. A system for producing compressed air, constructed and arranged and adapted to operate substantially as hereinbefore particularly described with reference to and as illustrated in Figs. 1 and 2 or Figs. 3 and 4 of the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.